

No of Pages : 3

Course Code: 08P401

Roll No:

(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, FEBRUARY / MARCH - 2015

BE / BE(SW) - PRODUCTION ENGINEERING Semester: 4

08P401 FLUID MECHANICS AND MACHINERY

Time: 3 Hours

Maximum Marks: 100

INSTRUCTIONS:

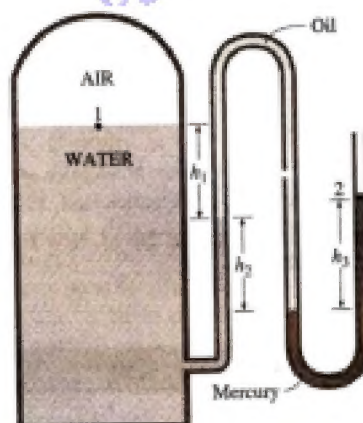
1. Group I and Group II questions should be answered in the Main Answer Book.
2. Answer any **FIVE** questions in Group II.
3. Answer **ALL** questions in Group I and Group III.
4. Group III – **Multiple Choice questions** - (which will be given to the candidates half an hour before the scheduled close of the examination) **should be answered only** in the space provided **in the Main Answer Book**.

GROUP I**Marks: 10 x 3 = 30**

1. Differentiate between absolute and gauge pressure.
2. Give an example each for Lagrangian and Eulerian methods of describing fluid flow.
3. State Navier - Stokes equation.
4. Write the discharge equation of an orificemeter.
5. Differentiate between total energy line and hydraulic gradient line.
6. Give an example where the minor losses in pipes are more significant.
7. Define vapor pressure.
8. What is the significance of Reynold's number in frictional loss calculation in pipes?
9. Define net positive suction head.
10. What is the significance of draft tubes in turbines?

GROUP II**Marks: 5 x 12 = 60**

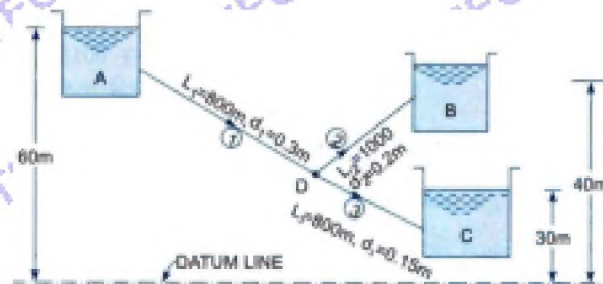
11. The water in a tank is pressurized by air and a multi-fluid manometer as shown in figure, measures the pressure. Determine the gage pressure of air in the tank with the following information. $h_1 = 0.2$ m; $h_2 = 0.3$ m; $h_3 = 0.46$ m; $\rho_{\text{water}} = 1000$ kg/m³; $\rho_{\text{air}} = 850$ kg/m³; $\rho_{\text{mercury}} = 13600$ kg/m³.



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12. Water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 L/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 196.2 kPa.
13. At a large fish hatchery the fish are reared in open, water filled tanks. Each tank is approximately square in shape with curved corners, and the walls are smooth. To create motion in the tanks, water is supplied through a pipe at the edge of the tank. The water is drained from the tank through an opening at the centre. A 1:13 scale model is to be used to determine the velocity V at various locations within the tank. Assume that $V = f(l, L, \rho, \mu, g, Q)$ where l is some characteristic length such as tank width, L represents a series of other pertinent lengths such as pipe diameter, fluid depth etc., ρ is the fluid density, g is the acceleration due to gravity, Q is the discharge through the tank. Determine the suitable set of dimensionless parameters. If water is to be used for the model, can all of the similarities be satisfied? Support the answer with suitable calculations. If the flow rate into the full sized tank is 950 L/min, determine the model discharge assuming Froude number similarity. What model depth will correspond to a depth of 80 cm in the full sized tank?
14. Three water reservoirs A, B and C are connected by a pipe system shown in figure. The lengths and diameters of pipes 1, 2, and 3 are 800 m, 1000 m and 800 m, 300 mm, 200 mm and 150 mm respectively. Determine the total head at the junction D. Also draw the total energy line and hydraulic gradient line for the given system.



15. The inlet and the outlet diameters of an inward flow reaction turbine with radial flow at the outlet are 1.20 m, 0.60 m respectively. Water enters the wheel at a velocity of 30 m/s at an angle of 30° to the wheel tangent and leaves the vanes with a velocity of flow of 4.20 m/s. The inlet and outlet vane angles of the moving vanes are 40° and 35° respectively. Find the power supplied to the runner and the speed of the turbine.
16. An oil pump is drawing 35 kW of electric power while pumping oil with $\rho = 860 \text{ kg/m}^3$ at a rate of $0.1 \text{ m}^3/\text{s}$. The inlet and the outlet diameters of the pipe are 8 cm and 12 cm respectively. If the pressure rise of oil in the pump is measured to be 400 kPa and the motor efficiency is 90%, determine the mechanical efficiency of the pump. Take the kinetic energy correction factor to be 1.05. Neglect the elevation difference across the pump.

/END/

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Write the Alphabet of your choice answer for each question in the space provided in the Main Answer Book

(Do not attach this question paper along with the Main Answer Book)

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GROUP III

Marks: 10 x 1 = 10

- I) A flow in which each liquid particle has a definite path and their paths do not cross each other is called
A) steady flow B) uniform flow C) streamline flow D) turbulent flow
- II) Cavitation is caused by
A) high velocity B) low barometric pressure C) high pressure D) low pressure
- III) Non uniform flow occurs when
A) direction and magnitude of velocity at all points are identical
B) velocity of fluid particles at any point is same at successive periods of time
C) magnitude and direction of velocity do not change from point to point in the fluid
D) velocity, pressure changes from point to point in the fluid
- IV) In parallel pipe problems
A) energy gradient remains same through all the pipes
B) head loss is same through all the pipes
C) total head loss is the sum of individual head loss through each pipe
D) hydraulic gradient remains same through all the pipes
- V) When the relation between Reynolds number and the friction factor is represented by a straight line, the flow is said to be
A) laminar B) isentropic C) turbulent D) vortex
- VI) Hydraulic grade line for any flow system as compared to energy line is
A) at same level B) above C) below D) uncertain
- VII) On a standard day a pressure gauge placed below the surface of the ocean (SG = 1.025) reads an absolute pressure of 1.4 MPa. How deep is this instrument?
A) 129m B) 4m C) 133m D) 140m
- VIII) For a given centrifugal pump
A) head varies inversely as the speed
B) the discharge varies directly as the speed
C) power varies as the square of the speed
D) discharge varies as the square of the speed
- IX) Which of the following turbine is preferred for 0 to 25m head of water?
A) Pelton B) Francis C) propeller D) Kaplan
- X) To replace a compound pipe by a new pipe, the pipes will be equivalent when both the pipes have same
A) length and flow rate B) diameter and flow rate
C) head loss and flow rate D) length and head loss